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(54) Title: METHOD AND COMPOSITION FOR COSMETICALLY REPAIRING A BLEMISH IN A POLYOLEFIN OBJECT		
(57) Abstract <p>There is disclosed a method and composition for cosmetically repairing a surface void in polyolefin objects. The method involves inserting a repair composition into the void and then applying heat thereto to fuse the repair composition with a surrounding portion of the polyolefin object. The repair composition is a physical mixture of a thermoplastic powder, a resin binder, and a solvent, having a paste-like consistency. The repair composition may be neutral in color, or may contain a colorant to closely match the underlying object. The heating step can be performed with an open flame or with a heat gun.</p>		

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1 **METHOD AND COMPOSITION FOR COSMETICALLY REPAIRING**
2 **A BLEMISH IN A POLYOLEFIN OBJECT**

3
4 **BACKGROUND OF THE INVENTION**

5 **Field of the invention.**

6 The invention relates generally to repairing molded polyolefin
7 object s and, more particularly, to a method and composition for cosmetically
8 repairing a surface blemish in such an object.

9
10 **Description of the related art.**

11 Polyolefin plastics are a broad category of materials including, but
12 not limited to, polyethylene, polypropylene, and ethyl-vinyl acetate. Numerous
13 everyday objects are made from polyolefin plastics (sometimes hereafter
14 "objects" or "polyolefin objects.") Such objects are commonly formed from
15 various molding operations such as injection molding, blow molding, rotational
16 molding, and so on.

17 The manufactures of polyolefin objects generally strive to achieve
18 highly efficient, cost-effective manufacturing processes to effectively compete in
19 their given markets. The foregoing molding processes invariably damage a
20 certain percentage of the objects, however, due to bad parting lines, trapped air
21 pockets, tight mold radii, difficult to mold resins, and the like. The damage is
22 often only cosmetic and not structural. The "damaged" object, therefore, could
23 easily perform its intended task. Because it is not marketable in its damaged
24 condition, however, the damaged object is usually discarded or ground up and

1 re-molded into subsequent objects, thereby increasing the overall
2 manufacturing cost and lowering the quality of the subsequent objects.

3 There remains a need, therefore, for a method and composition
4 for salvaging polyolefin objects which are nominally defective due only to
5 cosmetic blemishes.

6 OBJECTIVES OF THE INVENTION

7 It is an objective of this invention to provide a method for
8 cosmetically repairing a blemish in a polyolefin object.

9 It is a further objective of the invention to provide a method for
10 permanently repairing a blemish in a polyolefin object.

11 It is a further objective of the invention to provide a method for
12 cosmetically repairing a blemish in a polyolefin object wherein the repair
13 matches the color of the original object.

14 other and related objectives will be apparent from the following
15 description of the invention.

16

17 SUMMARY OF INVENTION

18 In a first aspect, the invention may be regarded as a method of
19 repairing a surface blemish consisting of a void in a surface of a polyolefin
20 object comprising the steps of: (a) inserting a repair composition into said void
21 wherein said repair composition consists essentially of: (i) 30 to 60 weight
22 percent of a thermoplastic component consisting of particulate polyolefin
23 powder selected from the group consisting of polyethylene, polypropylene, and
24 ethyl-vinyl acetate (EVA); (ii) 15 to 45 weight percent of a resin component

1 selected from the group consisting of aliphatic and aromatic hydrocarbon,
2 polyterpene, rosin and rosin-ester, chlorinated polyolefin resins, petroleum, and
3 synthetic and oxidized waxes; and (iii) 5 to 35 weight percent of an organic
4 solvent component; and (b) heating the repair composition in said void and a
5 surrounding portion of said polyolefin object by exposing the repair composition
6 and the surrounding portion of said polyolefin object to atmospheric heating at a
7 temperature sufficient to fuse said repair composition to said polyolefin object.

8 In a second aspect, the invention may be regarded as a repair
9 composition for repairing a surface blemish consisting of a void in a surface of a
10 polyolefin object, said repair composition consisting essentially of: (a) 30 to 60
11 weight percent of a thermoplastic component consisting of particulate polyolefin
12 powder selected from the group consisting of polyethylene, polypropylene, and
13 ethyl-vinyl acetate (EVA); (b) 15 to 45 weight percent of a resin component
14 selected from the group consisting of aliphatic and aromatic hydrocarbon,
15 polyterpene, rosin and rosin-ester, chlorinated polyolefin resins, petroleum, and
16 synthetic and oxidized waxes; and (c) 5 to 35 weight percent of an organic
17 solvent component

18 BRIEF DESCRIPTION OF THE DRAWINGS

19 The just summarized invention may best be understood with
20 reference to the Figures of which:
21

22 Figure 1 is a perspective view of a polyolefin object having a
23 cosmetic surface blemish;

24 Figure 2 is a close-up view of the surface blemish of Figure 1;

1 Figure 3 is a cross-sectional view of Figure 2, taken along section
2 lines 3-3, showing the wall of the polyolefin object and the void defining the
3 surface blemish;

4 Figures 4 to 7 show a method of repairing a surface blemish in a
5 polyolefin object according to this invention, the method comprising the steps of
6 filling a first portion of said blemish with a repair composition made according to
7 this invention and then heating the repair composition to a temperature
8 sufficient to fuse said repair composition with said polyolefin object; and

9 Figures 8 to 12 show additional steps that may be needed in
10 repairing a surface blemish in a polyolefin object according to this invention, the
11 additional steps being implemented if the initial repair steps of Figures 4 to 6
12 result in a recessed repair as shown in Figure 8, rather than a flush repair as
13 shown in Figure 7.

14

15 **BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS**

16 Figure 1 shows a typical polyolefin object 21 consisting of a pot
17 made by rotationally molding polyethylene. Such an object 21 may be
18 manufactured to have a texture and color such that the resulting object 21
19 appears substantially like a terracotta pot made of heavy, more expensive clay.
20 The particular object 21 shown is an exemplary object offered only to illustrate
21 the novel features of the present invention. The method and composition of this
22 invention, moreover, may be applied to virtually any object formed from a
23 polyolefin plastic object and the indication of polyethylene should also be
24 considered exemplary in nature.

1 Figures 1 furthers show that the polyolefin object 21 was
2 manufactured with a cosmetic imperfection or "blemish" 31 consisting of a small
3 void, pit, blow hole, or air pocket 32 (hereafter simply "void"). As noted above,
4 such a blemish 31 may render the polyolefin object 21 unmarketable and it may
5 be necessary to grind the object 21 or even discard it altogether. The method
6 and composition of this invention, however, makes it possible to perform
7 cosmetic repairs on polyolefin objects and thereby salvage objects which may
8 otherwise be treated as scrap.

9 Figures 2 and 3 show the hypothetical blemish 31 in more detail.
10 Figure 2, in particular, is a close-up view of the encircled portion of Figure 1,
11 showing the object 21 and its blemish 31. Figure 3, on the other hand, is a
12 cross-sectional view of Figure 2 taken along section lines 3-3, showing the
13 object's wall 21 and the blemish 31 from the side, with the latter's void 32
14 clearly visible. The challenge here was to develop an innovative method and
15 composition suitable for filling the void 32 and thereby eliminating the blemish
16 31.

17 The invention, therefore, comprises filling the void 32 with a
18 suitable repair composition and then atmospherically heating the repair
19 composition such that the repair composition flows fully into the void and fuses
20 with the underlying object 21.

21 The repair composition generally comprises a physical mixture of
22 a thermoplastic powder, a binder resin, and a solvent. The components and
23 relative proportions should be chosen such that the solvent forms less than
24 about 50 weight percent of the overall composition such that the resulting repair

1 composition has a paste-like consistency and can, therefore, remain in the void
2 32 prior to and during the application of heat and, perhaps, during an
3 intermediate evaporation period.

4 The first component of the preferred repair composition is a
5 thermoplastic component consisting of particulate polyolefin powder selected
6 from the group consisting of polyethylene (e.g. ultra-high molecular weight
7 polyethylene), polypropylene, and ethyl-vinyl acetate (EVA). The possible
8 polyethylene include ultra-high molecular weight polyethylene (UHD),
9 high-density polyethylene (HD), low-density polyethylene (LD), and linear low
10 density polyethylene. UHD is not often used to make the underlying polyolefin
11 object because does not flow very well and is hard to process. UHS may be
12 suitable for this application, however, because it has exceptional abrasion
13 characteristics that provide a tough repair patch. The particulate polyolefin
14 powder should have a particle size of about 50 mesh down to 5 microns in size
15 and a relatively low melt index of 100 or below. The particulate polyolefin
16 powder should make up 30 to 60 weight percent of the overall repair
17 composition.

18 The second component of the preferred repair composition is a
19 binder resin selected from the group consisting of aliphatic and aromatic
20 hydrocarbon, polyterpene, rosin and rosin-ester, chlorinated polyolefin resins,
21 petroleum, and synthetic and oxidized waxes. The preferred binder resin
22 component is a cycloaliphatic hydrocarbon resin having a water white color
23 which, at least to some degree, transmits the color of the underlying polyolefin
24 object after completing the repair. The binder resin should make up 15 to 45

1 weight percent of the overall repair composition.

2 The third component of the preferred repair composition is a
3 solvent including any organic solvent that will dissolve the selected binder
4 resins. The possible solvents include water, Toluene, Hexane, and 1 chloro-4
5 (TriFluormethylbenzene). Water may be used, but it tends to evaporate very
6 slowly. 1 chloro-4 (TriFluormethylbenzene) is desirable for many applications
7 because it evaporates relative quickly, but is not flammable.

8 Finally, in lieu of relying on the translucent nature of the neutral
9 "water white" color of the particular binder resin as discussed above, the repair
10 composition may optionally include an appropriate colorant that proactively
11 causes the resulting repair patch to closely match the color of the polyolefin
12 object 21. The use of a colorant may beneficially ensure a seamless match
13 between the patch and the product. The colorant may be any suitable pigment
14 or dye. Inorganic pigments that are useful include titanium dioxides (rutile ,
15 anatase), zinc oxide, iron oxides in hues such as yellow, buff, tan, brown,
16 salmon and black, iron chromates and molybdates for colors from light yellow to
17 red orange, lead chromates, lead sulfate, lead molybdate, chrome yellows and
18 oranges, cadmium pigments in a variety of yellows, oranges, reds and maroons
19 as pure cadmium colors or with barium sulfide (lithopones), cadmium mercury
20 mixtures, cadmium sulfide or cadmium sulfoselenides, nickel and titanium dioxide
21 mixtures, sodium, potassium or ammonium coordination compounds of
22 ferri-ferrocyanide, ultramarine blues, (a calcined mixture of china clay, sodium
23 carbonate, silica, sulfur and reducing agents), cobalt aluminate (cobalt blues),
24 chromium oxide, metal flake pigments such as aluminum, zinc, copper, bronze

1 powders, metal silver pigments, pearlescent and iridescent flakes of basic lead
2 carbonates, bismuth oxychlorides and titanium coated mica etc. Various
3 organic pigments which are useful include azo pigments, such as
4 benzimidazolone pigments, pyrazalone pigments, copper phthalocyanine,
5 quinacridones, anthraquinones, condensation pigments,
6 tetra-chloro-isindolinones, carbon blacks, etc.

7 In summary, the repair composition consists essentially of: (a) 30
8 to 60 weight percent of a thermoplastic component consisting of particulate
9 polyolefin powder selected from the group consisting of polyethylene (e.g.
10 ultra-high molecular weight polyethylene), polypropylene, and ethyl-vinyl
11 acetate (EVA); (b) 15 to 45 weight percent of a resin component selected from
12 the group consisting of aliphatic and aromatic hydrocarbon, polyterpene, rosin
13 and rosin-ester, chlorinated polyolefin resins, petroleum, and synthetic and
14 oxidized waxes; and (c) 5 to 35 weight percent of a solvent component (e.g.
15 water). A colorant is optional.

16 The preferred repair composition is specifically designed to repair
17 polyolefin objects formed from polyethylene. The preferred repair composition,
18 one that is particularly suitable for such purpose, consists essentially of about
19 44 weight percent of a polyethelene powder having a melt index of 100 or
20 below; about 36 weight percent of a cycloalipathic hydrocarbon resin that is
21 compatible with the polyethelene powder when heat is applied (e.g. a softening
22 point and ultimate viscosity at the anticipated temperature) and has a desirable
23 color (e.g. water white as opposed to brown or yellow so that it that may be
24 suitable without colorant or is compatible with the use of a colorant); and about

1 20 weight percent of a non-flammable solvent called 1 chloro-4
2 (TriFluormethylbenzene) such that the composition is not flammable, paste-like,
3 and easily evaporated.

4 The ingredients should be intimately admixed and blended, a
5 process which may be accomplished in any machine that can handle paste-like
6 products. Examples of such mixers include planetary mixers, horizontal
7 kneaders, extruders, and any other mixer that can handle high viscosity
8 materials.

9 Figures 4 to 7 illustrate the steps of a first preferred method of
10 repairing a polyolefin object using a repair composition according to this
11 invention.

12 The first step generally comprises the step of filling a first portion
13 of the void 32 with the repair composition 41. The repair composition 41 may
14 be transported in any suitable container (e.g. bottle, can, squeeze tube, and so
15 on) and then automatically or manually delivered to the void 32 in any suitable
16 manner (e.g. the end of a screw driver, a tooth pick, a putty knife). Figure 4
17 shows a preferred delivery manner where a small amount of repair composition
18 41 is squeezed out of a tube 40 and directly into the void 32. Figure 5 shows
19 the void 32 filled with the repair composition 41 and, as may sometimes be
20 desired, slightly over-filled to allow for subsequent shrinkage.

21 The second step generally comprises heating the repair
22 composition 41 filling the void 32 by exposing the repair composition 41 to
23 atmospheric pressure heating at a temperature sufficient to fuse the repair
24 composition 41 with the underlying object 21 containing the blemish 31. The

1 preferred way of implementing the heating steps us an open flame or hot air
2 from a heat gun so as to increase the temperature of the repair composition 41
3 and the surrounding portion of the object 21 to at least 270 degrees Fahrenheit.
4 Figure 6, in particular, shows a propane torch 50 being used to apply heat
5 through the direct application of an open flame. Other methods of applying
6 heat may be used, but care should be taken to heat only the area of the repair
7 and to make sure that warpage or discoloration does not occur due to
8 overheating the patch or surrounding plastic area. Figure 7 shows the final
9 repair wherein the repair composition 41 is suitable flush with the surface of the
10 underlying object 21.

11 The solvent in the repair composition is preferably allowed to
12 evaporate before applying heat to the composition because the application of
13 high temperature heat may form bubbles within the patch. The evaporation
14 may occur at ambient temperatures or by way of "forced evaporation" through
15 the application of heat at an elevated temperature that is sufficiently high to
16 speed up evaporation, but is below the melting point of the particulate polyolefin
17 powder. Forced evaporation may be conveniently implemented through the
18 use of a heat gun held at a distance from the patch.

19 Figures 8 to 12 illustrate additional repair steps which my be
20 desired given a deep void 32 where it may be desired to apply several thin
21 layers of the repair composition 41 to ensure that each incremental amount of
22 composition 41 is heat cured during each intermediate heating step. Figure 8,
23 in particular, shows an intermediate repair that is recessed after completion of
24 steps 4 to 6 rather than flush as shown in Figure 7. In this case, as shown in

1 Figure 9, an additional filling step is implemented wherein more repair
2 composition 42 is inserted into the void 32 and on top of the repair composition
3 that was previously inserted therein and heated (steps 4 to 6). Figure 10 shows
4 the state of the repair after inserting the section portion of repair composition 42
5 and Figure 11 shows the application of heat thereto. Figure 12 shows the final
6 state of the repair.

7 The invention has been described with reference to a presently
8 preferred embodiment and particular polyolefin object. It is not intended that the
9 invention be unduly limited by this disclosure, but rather is intended that the
10 invention be defined by the following claims.

11

WE CLAIM:

- 1 1. A method of repairing a surface blemish consisting of a void in
2 a surface of a polyolefin object comprising the steps of:
3 (a) inserting a repair composition into said void wherein said repair
4 composition consists essentially of:
5 (i) 30 to 60 weight percent of a thermoplastic component
6 consisting of particulate polyolefin powder selected
7 from the group consisting of polyethylene,
8 polypropylene, and ethyl-vinyl acetate (EVA);
9 (ii) 15 to 45 weight percent of a resin component selected
10 from the group consisting of aliphatic and aromatic
11 hydrocarbon, polyterpene, rosin and rosin-ester,
12 chlorinated polyolefin resins, petroleum, and
13 synthetic and oxidized waxes; and
14 (iii) 5 to 35 weight percent of an organic solvent
15 component; and
16 (b) heating the repair composition in said void and a surrounding
17 portion of said polyolefin object by exposing the repair
18 composition and the surrounding portion of said polyolefin
19 object to atmospheric heating at a temperature sufficient to
20 fuse said repair composition to said polyolefin object.

- 1 2. The method of Claim 1 wherein said step of inserting a repair
2 composition into said void is accomplished by squeezing said repair

3 composition from a tube containing a supply of said repair composition.

1 3. The method of Claim 1 wherein said repair composition further
2 includes a colorant.

1 4. The method of Claim 3 wherein said colorant substantially
2 matches a color of said polyolefin object.

1 5. The method of Claim 3 wherein said colorant is a pigment.

1 6. The method of Claim 3 wherein said colorant is a dye.

1 7. The method of Claim 1 wherein said repair composition is
2 sufficiently translucent to transmit a color of said polyolefin object.

1 8. The method of Claim 7 wherein said binder resin is a
2 cycloaliphatic hydrocarbon resin having a water white color.

1 9. The method of Claim 1 wherein said polyolefin object is a
2 polyethylene object.

1 10. The method of Claim 1 wherein said heating step is
2 accomplished by applying an open flame to the repair composition in the void.

1 11. The method of Claim 1 wherein said heating step is
2 accomplished by applying hot air from a heat gun to the repair composition in
3 the void.

1 12. The method of Claim 1 wherein the repair composition fills
2 substantially all of said void after the heating step.

1 13. The method of Claim 1 wherein a first portion of the repair
2 composition fills a lower portion of said void after the heating step.

1 14. The method of Claim 13 comprising the further steps of:
2 (a) inserting a second portion of repair composition into said void,
3 above said first portion of repair composition, wherein said
4 repair composition; and
5 (b) heating the second portion of repair composition in said void
6 and a surrounding portion of said polyolefin object by
7 exposing the second portion of repair composition and the
8 surrounding portion of said polyolefin object to atmospheric
9 heating at a temperature sufficient to fuse said second
10 portion of repair composition to said polyolefin object.

1 15. The method of Claim 14 including the further steps of
2 repeating the inserting and heating steps until the repair composition fills the
3 void and is substantially flush with a surface of the polyolefin object.

1

1 16. A repair composition for repairing a surface blemish
2 consisting of a void in a surface of a polyolefin object, said repair composition
3 consisting essentially of:

4 (a) 30 to 60 weight percent of a thermoplastic component
5 consisting of particulate polyolefin powder selected from
6 the group consisting of polyethylene, polypropylene, and
7 ethyl-vinyl acetate (EVA);
8 (b) 15 to 45 weight percent of a resin component selected from
9 the group consisting of aliphatic and aromatic hydrocarbon,
10 polyterpene, rosin and rosin-ester, chlorinated polyolefin
11 resins, petroleum, and synthetic and oxidized waxes; and
12 (c) 5 to 35 weight percent of an organic solvent component.

1 17. The repair composition of Claim 16 wherein said
2 thermoplastic component is an high-density polyethylene.

1 18. The repair composition of Claim 16 wherein said repair
2 composition further includes a colorant.

1 19. The repair composition of Claim 18 wherein said colorant
2 substantially matches a color of said polyolefin object.

1 20. The repair composition of Claim 19 wherein said colorant is a
2 pigment.

1 21. The repair composition of Claim 19 wherein said colorant is a
2 dye.

3 22. The repair composition of Claim 16 wherein said repair
4 composition is sufficiently translucent to transmit a color of said polyolefin
5 object.

1 23. The repair composition of Claim 22 said binder resin is a
2 cycloaliphatic hydrocarbon resin having a water white color.

1 24. The repair composition of Claim 16 wherein the organic
2 solvent component is selected from the group consisting of water, Toluene,
3 Hexane, and 1 chloro-4 (TriFluormethylbenzene).

4

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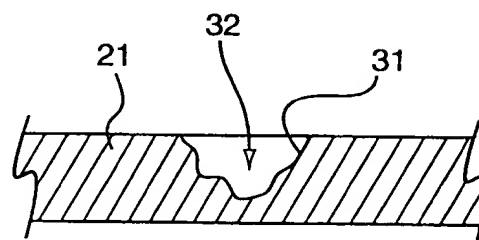
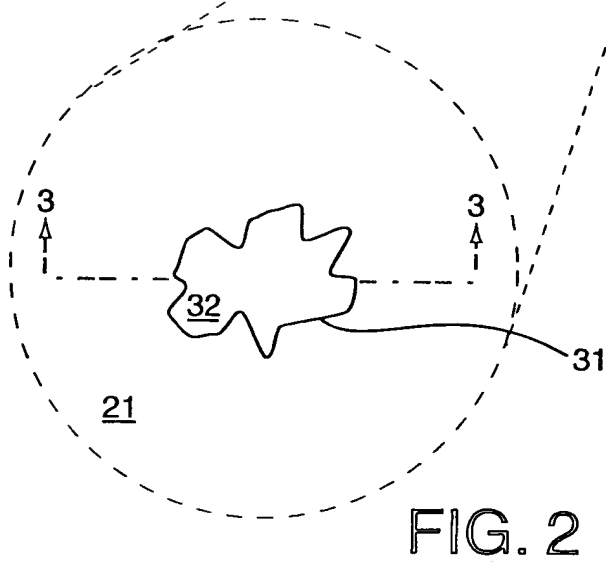
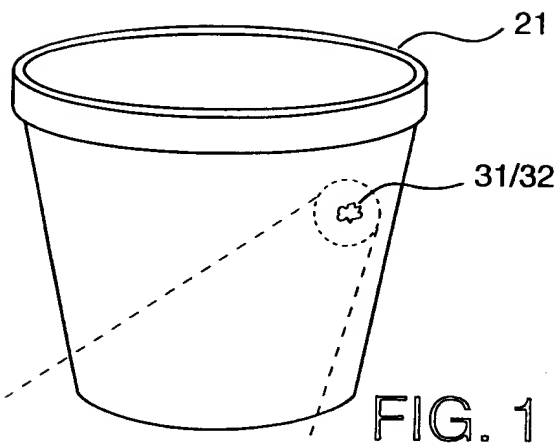


FIG. 3

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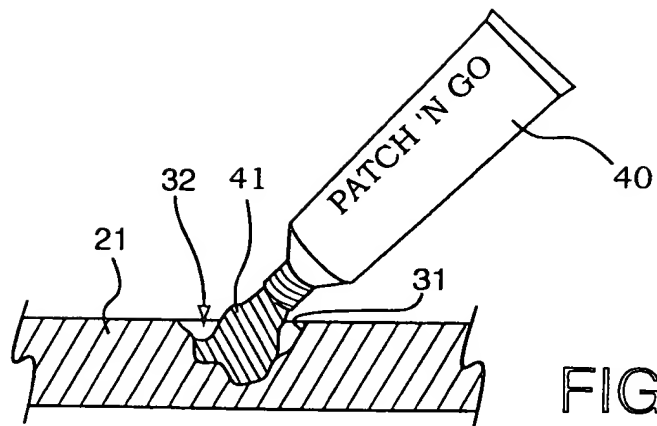


FIG. 4

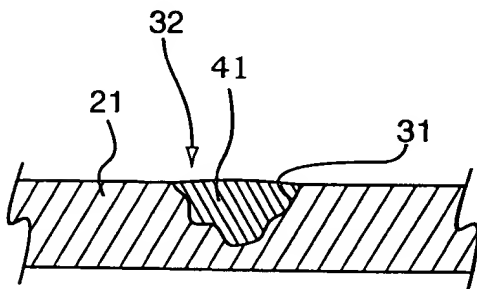


FIG. 5

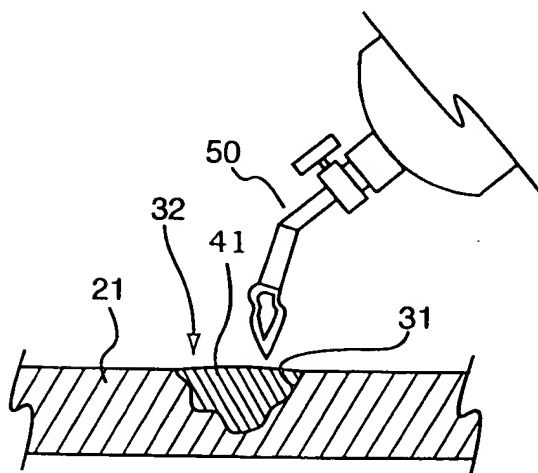


FIG. 6

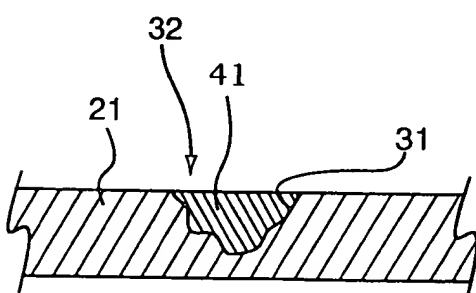


FIG. 7

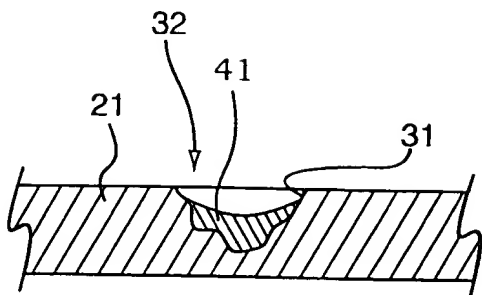


FIG. 8

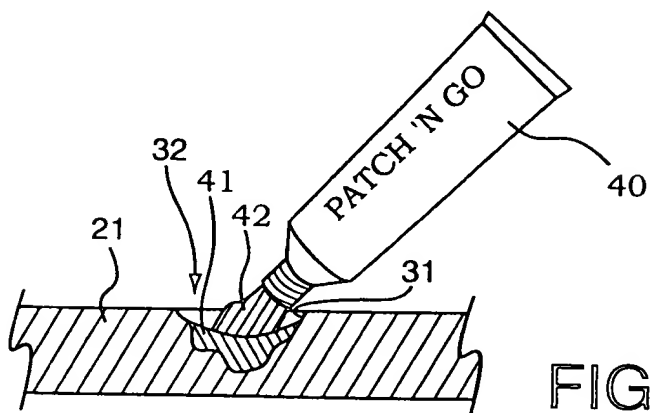


FIG. 9

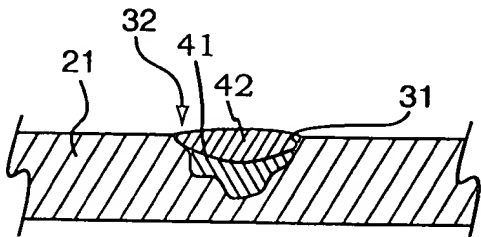


FIG. 10

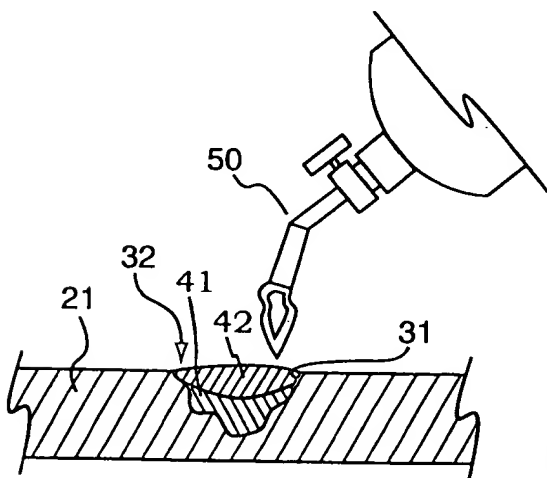


FIG. 11

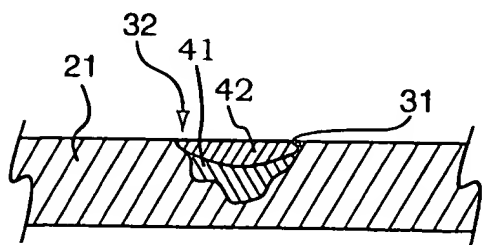


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/04624**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : B32B 35/00

US CL : US CL: 156/94

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : US CL: 156/82, 94; 524/462, 464, 475, 476, 484, 487, 563, 583, 585, 587; 528/503

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
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NONE**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,067,156 A (BRANTON) 04 DECEMBER 1962	17-24
A	US 3,227,669 A (SAUER) 04 January 1966.	17-24
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A	US 3,607,808 A (THOMPSON et al) 21 September 1971.	17-24
A	US 5,358,994 A (MALLOW) 25 October 1994.	1-24

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